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EUROPEAN
ATHLETICS

COACHING SUMMIT SERIES

Biomechanical Factors in Race Walking Injuries

Brian Hanley



Biomechanics Factors in Race Walking Injuries



Courtesy of Bengt Bengtsson

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Injury questionnaire

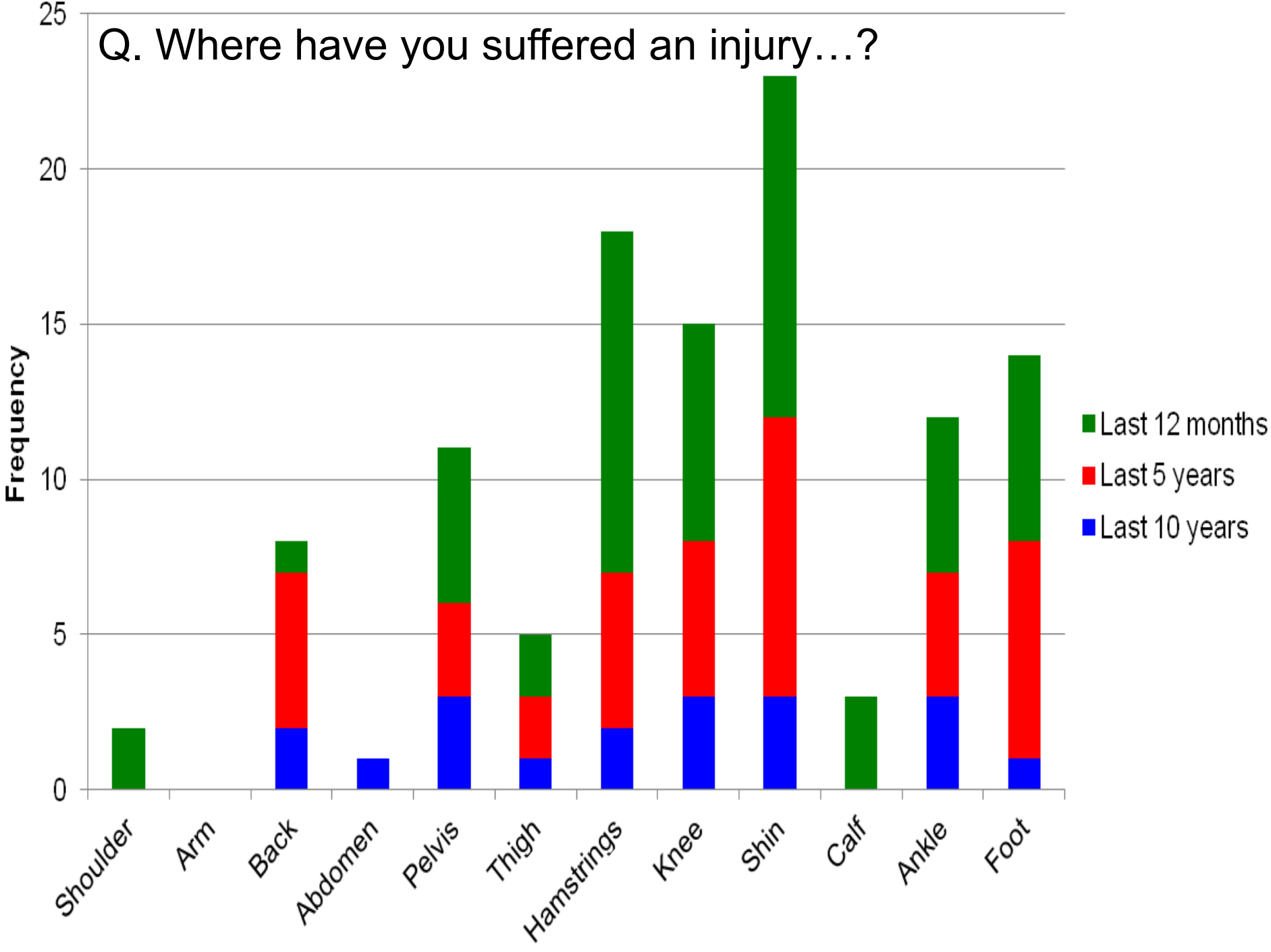
- Questionnaires were distributed to junior and senior competitors at the 2012 World Cup in Saransk. The questionnaires were available in English, French, German, Spanish and Russian.* Fifty athletes of 11 different nationalities completed the questionnaire (33 men / 17 women)
- 39 of the 50 athletes who answered had a race walking-related injury in the previous 10 years (112 injuries in total). 69 of these injuries required medical attention and 69 required time off training to recover (not all the same injuries).

* With thanks to Rosie Hanley, Catherine Bousquet, Wolfgang Keinhorst, Sebastian Ponce and Olga Lawler for assistance with translation.

Injury questionnaire

- The average man:
 - Began race walk training at 14 years of age
 - Had been race walking for 11 years
 - Completed 132 km per week
 - Had a longest weekly training session of 33 km
- The average woman:
 - Began race walk training at 16 years of age
 - Had been race walking for 8 years
 - Completed 99 km per week
 - Had a longest weekly training session of 21 km

Q. Where have you suffered an injury...?

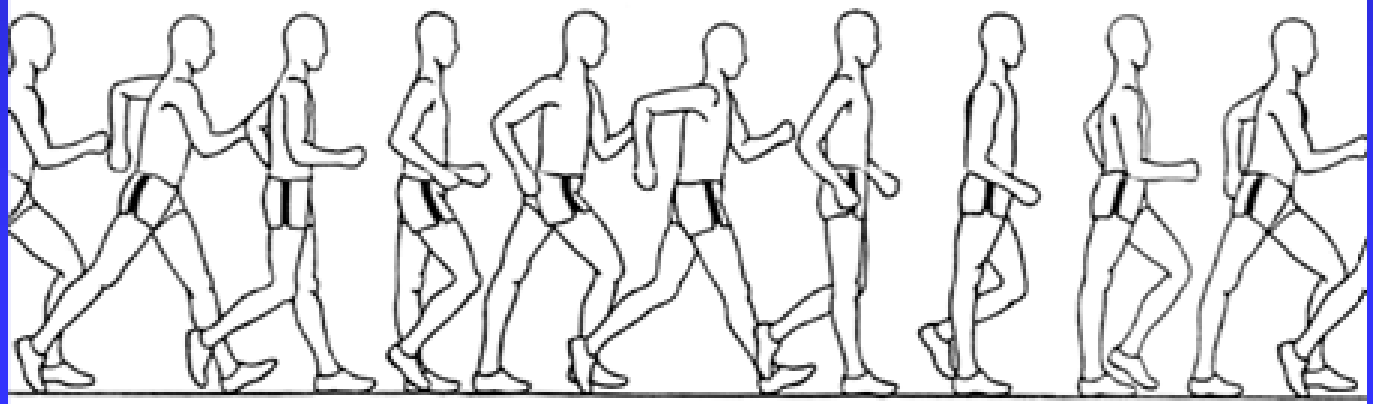
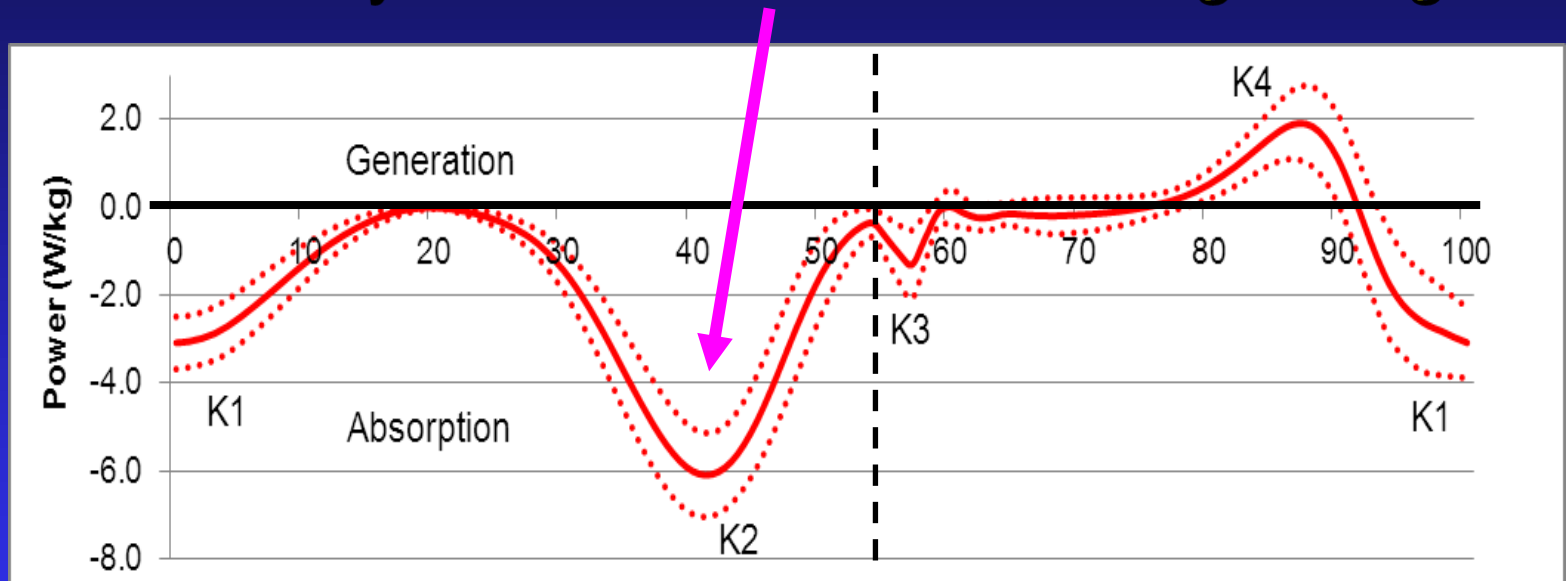


Injuries

- Francis et al. (1998) also found that the most commonly reported injuries in non-elite race walkers were to the hamstrings and shins. Hamstring injuries are also common in competitive running and sports involving fast running due to peak stretch and eccentric contraction during swing (Chumanov et al., 2011).
- In effect, the hamstrings are in danger of being torn because they are being stretched quickly due to the rapid extension of the knee.

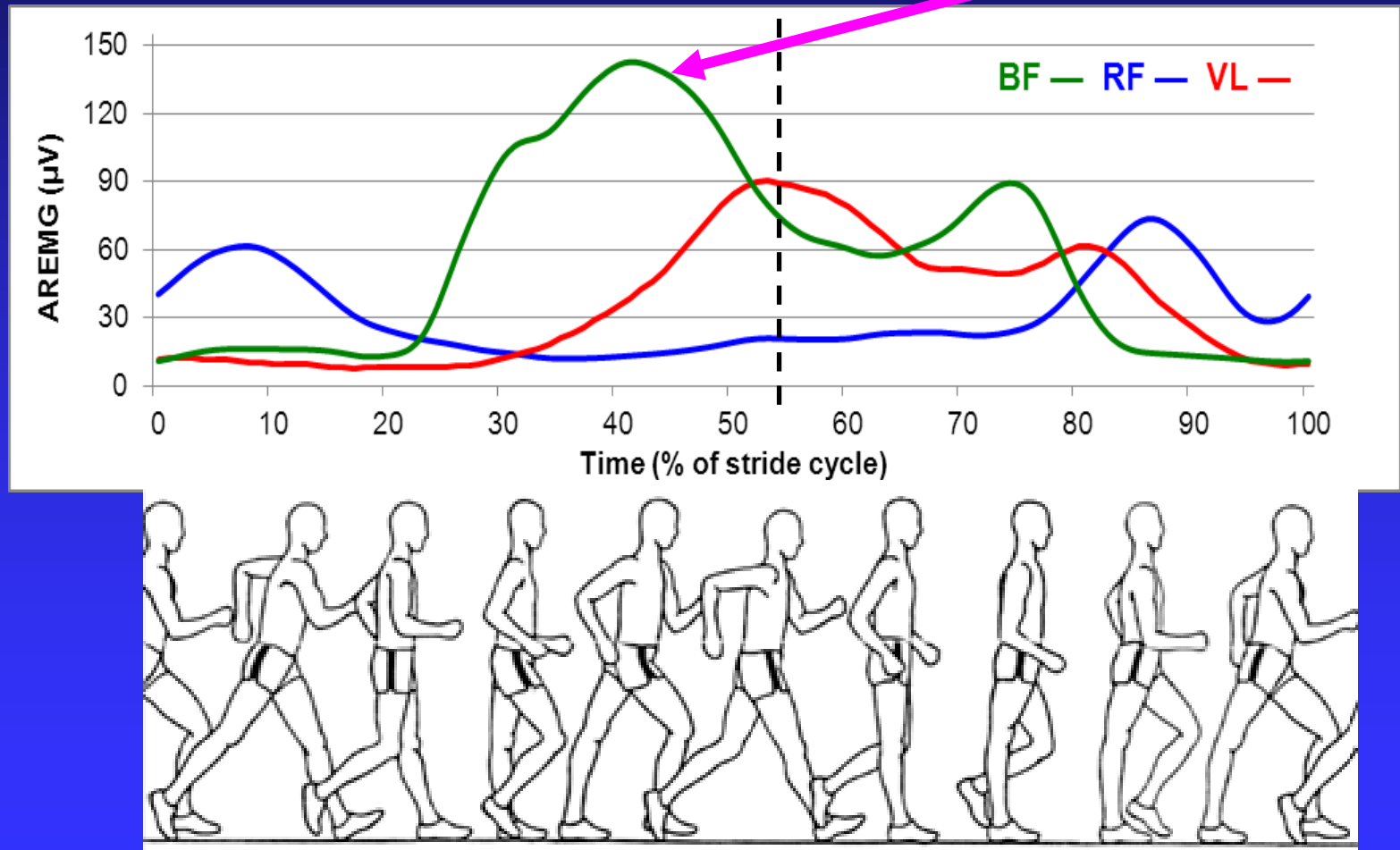
Hamstrings - eccentric contraction

We have measured the amount of energy absorbed by the knee muscles during swing.



Hamstring activity

We measured the activity of the biceps femoris muscle – note its activity during late swing.

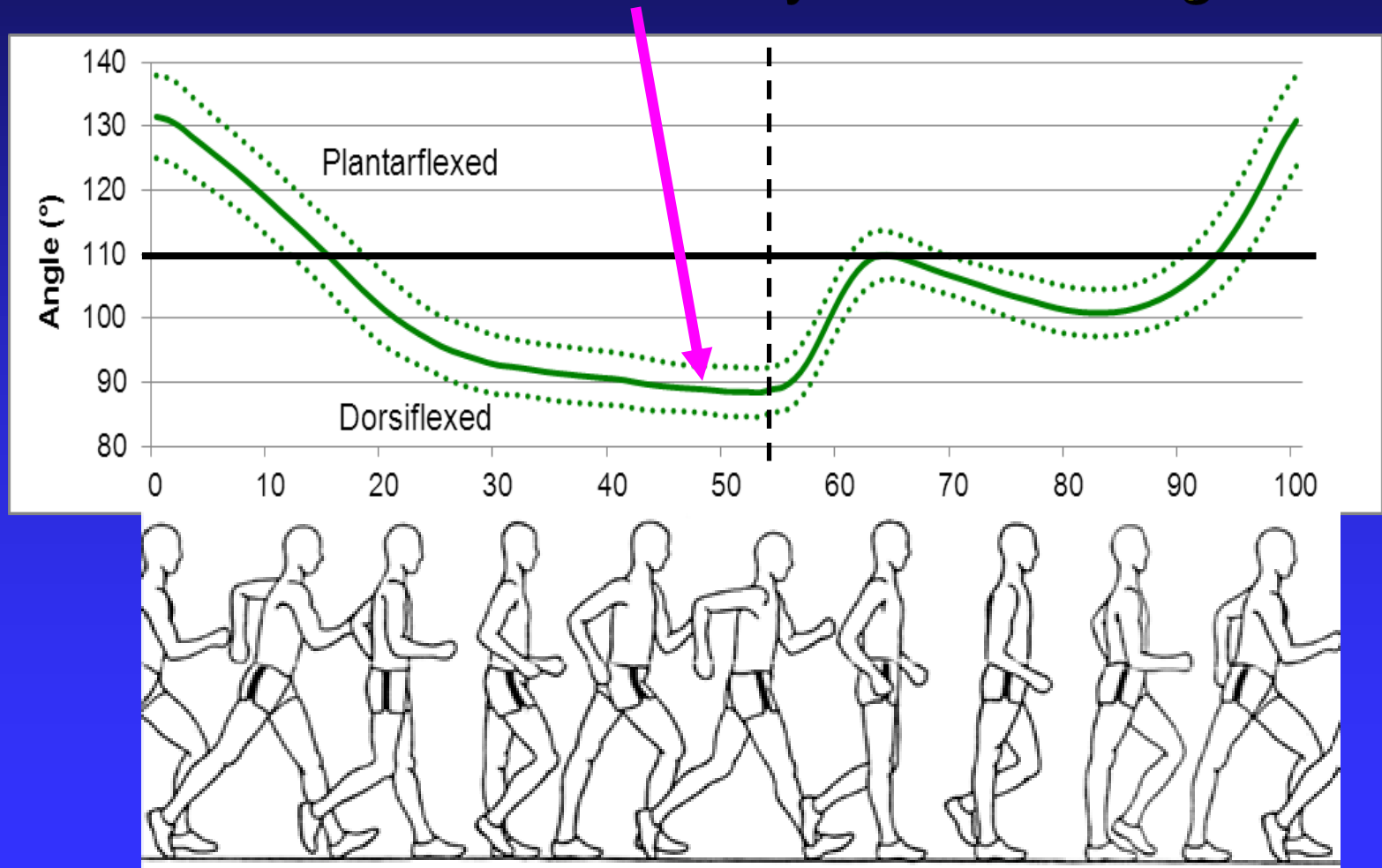


Shin Pain

- When we walk normally, we speed up until our bodies decide it is better to run instead. It is believed that the reason we switch from walking to running is to reduce high levels of stress in the tibialis anterior muscle (Hreljac et al., 2008) as well as in the rectus femoris and hamstrings during the swing phase (Prilutsky & Gregor, 2001).
- The fact that race walkers cannot adopt a walk-to-run transition to reduce the exaggerated activation of tibialis anterior and other shin muscles at fast speeds might be a cause of the well-documented shin pain.

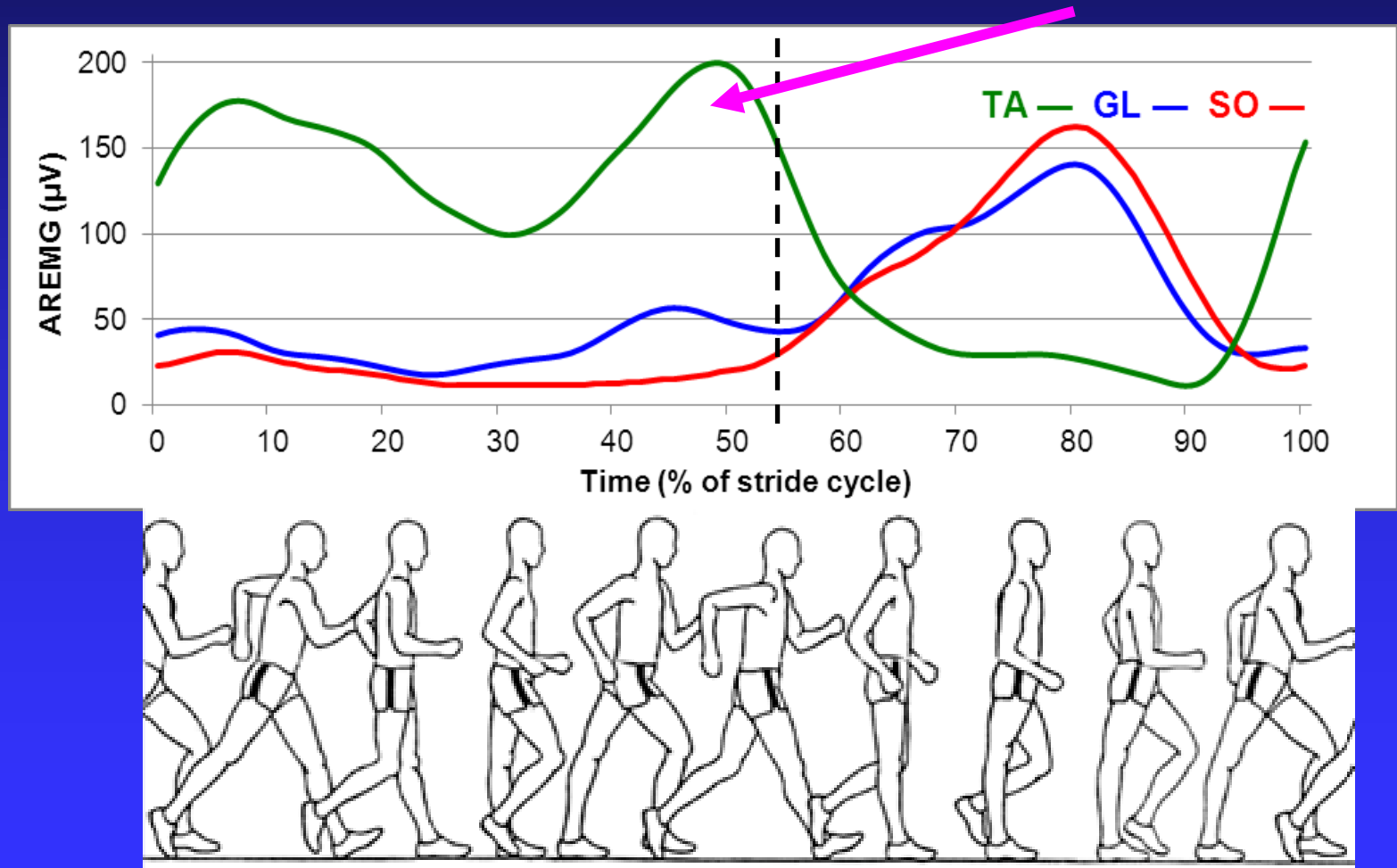
Ankle dorsiflexion

Our results show that race walkers continually try to dorsiflex their ankles to try to clear the ground



Ankle dorsiflexion

This results in a large activation of the tibialis anterior muscle which experiences great stress



Shin Pain

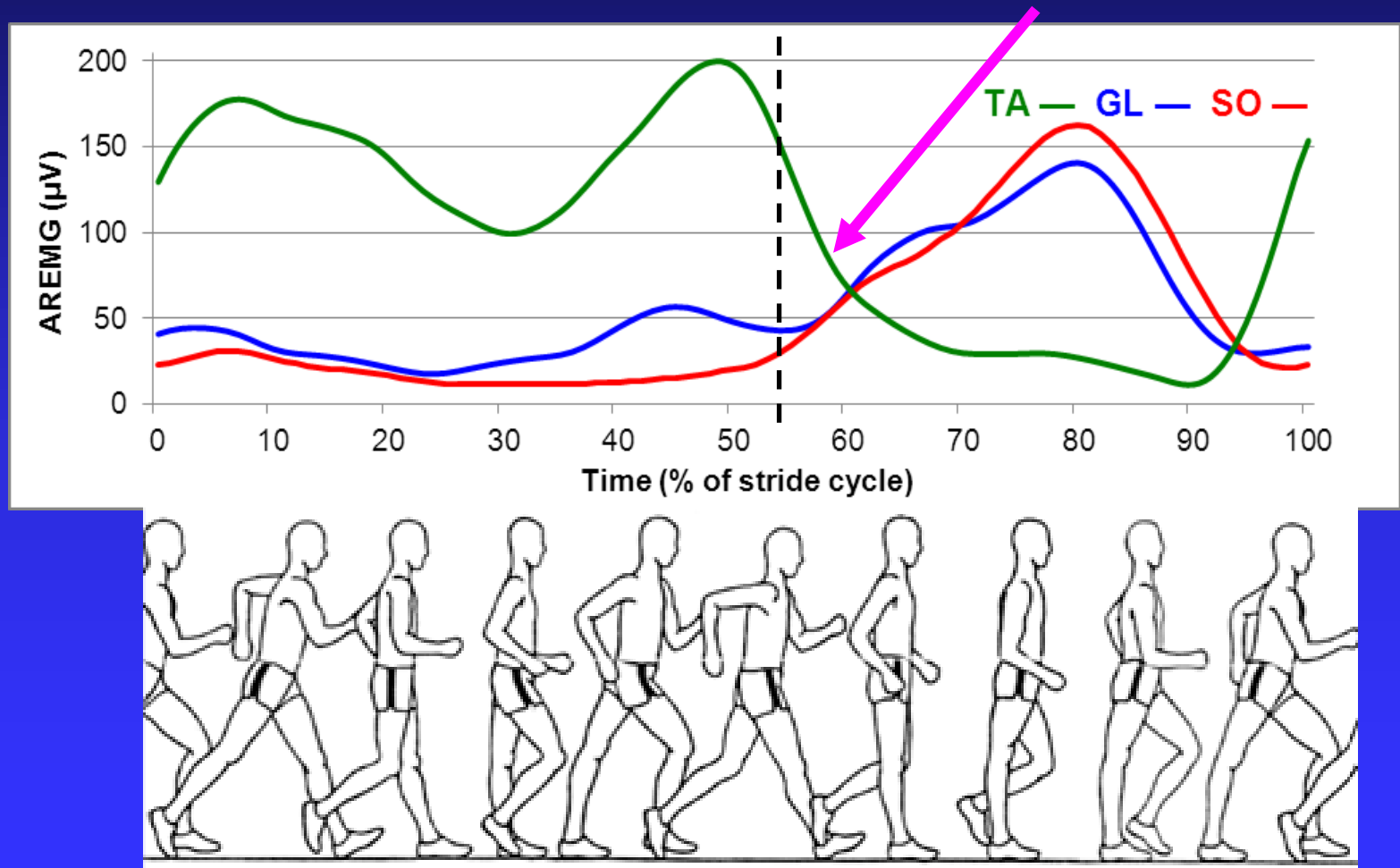
- However, the speed at which the transition from walking to running occurred was found to be higher in sub-elite race walkers (Ziv & Rotstein, 2009) and this might be due to improved training of the ankle dorsiflexors and plantarflexors (Ziv & Rotstein, 2009).
- In other words, we can reduce the risk of pain and injury in the shin muscles with appropriate strength training and correct technique. The complication is that the ankle is having to take over some of the knee's role in ground clearance – but we want to avoid too much knee flexion!

Shin Pain

- Another possible cause of shin muscle pain is due to the eccentric contractions experienced as the ankle plantarflexes during pronation (Sanzén et al., 1986) which is associated with the need for a straightened knee as the ankle must undertake the function of lowering the body that knee flexion undertakes in running.
- Our research actually found that these contractions were not as predominant as previously thought although there were some individual variations (particularly in junior men).

Ankle dorsiflexion

We found that most elite race walkers had smooth, efficient ankle movements during this gait event



Other considerations

- The source of an injury is often in another part of the body to that which is injured.
- Some injuries are possibly caused by the straightened knee's effect on the position of the foot (the whole leg is rotated inwards). Exercises to strengthen the hip might be necessary here.
- It is not necessarily the amount of stress or how often it occurs which causes the injury – it can be the *type* of stress (e.g. torsion / twisting is worse than tension / pulling).
- Most running injuries are caused by training errors, such as incorrect progression or overload.

References

- Chumanov, E. S., Heiderscheit, B. C. & Thelen D. G. (2011) Hamstring musculotendon dynamics during stance and swing phases of high-speed running. *Medicine and Science in Sports and Exercise*, 43(3), pp.525-532.
- Francis, P. R., Richman, N. M. & Patterson, P. (1998) Injuries in the sport of racewalking. *Journal of Athletic Training*, 33(2), pp.122-129.
- Hreljac, A., Imamura, R. T., Escamilla, R. F., Edwards, W. B. & MacLeod, T. (2008) The relationship between joint kinetic factors and the walk-run gait transition speed during human locomotion. *Journal of Applied Biomechanics*, 24(2), pp.149-157.

References

- Prilutsky, B. I. & Gregor, R. J. (2001) Swing- and support-related muscle actions differentially trigger human walk-run and run-walk transitions. *The Journal of Experimental Biology*, 204(13), pp.2277-2287
- Sanzén, L., Forsberg, A. & Westlin, N. (1986) Anterior tibial compartment pressure during race walking. *The American Journal of Sports Medicine*, 14(2), pp.136-138.
- Ziv, G. & Rotstein, A. (2009) Physiological characteristics of the preferred transition speed in racewalkers. *Medicine and Science in Sports and Exercise*, 41(4), pp.797-804.